U.S. Department
of Transportation
Federal Aviation
Administration

Advisory Circular

Subject:	INSTALLATION DETAILS FOR LAND AND HOLD SHORT LIGHTING SYSTEMS	**Date:**	12/30/99	**AC No.:**	150/5340-29
		Initiated by:	AAS-200	**Change:**	

1. PURPOSE. This advisory circular (AC) contains the Federal Aviation Administration (FAA) standards for the design and installation of land and hold short lighting systems.

2. APPLICATION. The design and installation criteria contained herein are recommended by the FAA for all applications involving land and hold short lighting systems. However, FAA standards, where noted, are mandatory for those projects receiving Federal funds under the airport grant assistance program or the passenger facility charge program.

3. METRICS. To promote an orderly transition to metric units, this AC contains both English and metric dimensions. The metric conversions may not be exact metric equivalents, and until there is an official changeover to the metric system, the English dimensions will govern.

4. COMMENTS. Comments or suggestions for improvements to this AC should be sent to:

Federal Aviation Administration
Attn: Manager, Engineering and
Specifications Division, AAS-200
800 Independence Ave., SW
Washington, DC 20591

David L. Bennett
Director of Airport Safety and Standards

5. COPIES OF THIS AC. The Office of Airport Safety and Standards is in the process of making ACs within their purview available to the public through the Internet. These ACs may be found through the FAA home page at: www.faa.gov. To get to the advisory circular area, select "FAA Organizations," then "Airports," followed by "Advisory Circulars." A printed copy of this and other ACs may be ordered from the:

U.S. Department of Transportation
Subsequent Business Office
Annmore East Business Center
3341 Q 75th Avenue
Landover, MD 20785

They may also be ordered through the AC Checklist which may be accessed through the FAA home page at: www.faa.gov. Select "Site Help & Search." Search on "ABC." Select "Office of Business Information and Consultation (ABC)." Then select "Advisory Circular Checklist."

TABLE OF CONTENTS

INSTALLATION DETAILS FOR LAND AND HOLD SHORT LIGHTING SYSTEMS

1. INTRODUCTION. Land and hold short lighting systems are installed to indicate the location of hold-short points on runways approved for land and hold short operations (LAHSO).

2. BACKGROUND. FAA Notice 7110.199, *Land and Hold Short Operations (LAHSO)*, provides operational requirements for lighting systems and other visual navigational aids that are required to conduct LAHSO.

3. DEFINITIONS.

a. Available Landing Distance (ALD) - That portion of a runway available for landing roll-out for aircraft cleared for LAHSO. This distance is measured from the landing threshold to the hold-short point.

b. Hold-Short Point - A point on the runway beyond which a landing aircraft with a LAHSO clearance is not authorized to cross.

c. Land and Hold Short Operations (LAHSO) - These operations include landing and holding short of an intersecting runway, a taxiway, a predetermined point, or an approach/departure flightpath.

4. IMPLEMENTATION CRITERIA. Install land and hold short lighting systems at locations described in the letter of agreement between the airport authority and the local Airport Traffic Control Tower (ATCT). See FAA Notice 7110.199 for information on the letter of agreement.

5. CONFIGURATION. A land and hold short lighting system consists of a row of six or seven in-pavement unidirectional pulsing white lights installed across the runway at the hold-short point. A 6-light bar is standard for new installations. A 7-light bar is standard for airports with existing 5-light bars. Five-light bars should be upgraded to meet the standard by adding a light fixture on each end of the existing installation, with the same spacing as the existing fixtures. Selection of the 6- or 7-light bar is not based on the presence of runway centerline lights.

a. Location. The light fixtures should be centered on an imaginary line which is parallel to, and 2 feet (610 mm), -0 ft (0 mm), +3 feet (915 mm), prior to the holding side of the runway holding position marking, as shown in Appendix 2, Figure 1. Individual fixtures may vary from the imaginary line up to ±2 inches (51 mm) in a direction parallel to the runway centerline. Fixtures should be installed so that their nearest edge is approximately 2 feet (610 mm) from any rigid pavement joint or another fixture. In the event of a conflict between any of the light fixtures and undesirable areas, such as rigid pavement joints, etc., which cannot be resolved through the 3 foot (915 mm) longitudinal tolerance or by varying the lateral spacing as specified in the following paragraph, the holding position marking and the entire land and hold short lighting system should be moved sufficiently toward the landing threshold (shortening the available landing distance) to resolve the conflict.

b. Lateral Spacing of Light Fixtures. The total width of the row of lights (measured between the centers of the outboard fixtures) should be 50% (±10%) of the defined runway width for 6-light bars, as shown in Appendix 2, Figure 1, and 65% (+5%, -15%) for 7-light bars,. The remaining lights should be uniformly spaced between the outboard fixtures within a tolerance of ±2 inches (51 mm). The light bar should be symmetrically disposed about the runway centerline for 6-light bars, or about the center fixture for 7-light bars. The center fixture in 7-light bars should be located laterally on the runway in accordance with the criteria for runway centerline lights. See AC 150/5340-4, *Installation Details for Runway Centerline and Touchdown Zone Lighting Systems*.

6. DESIGN. Land and hold short lighting systems are designed for installation in new or existing rigid or flexible pavements. When possible, installation of land and hold short lighting systems should be done during construction of the runway or when the pavement is being overlaid. This would allow for the installation of L-868 light bases interconnected by conduit, which is preferred. In this system, the isolation transformers are contained within the light bases.

a. Light Fixtures and Electrical Cables. One of two types of fixtures may be selected for the land and hold short lighting system: 1) L-850F, unidirectional white light, or 2) L-850A unidirectional white light, in accordance with AC 150/5345-46, *Specification for Runway and Taxiway Light Fixtures*. The fixtures are similar except that the L-850F fixture includes a second lamp which illuminates in the event the first lamp fails. The system should be designed for the appropriate pavement condition listed below:

(1) New pavements. In new pavements, provide access to electrical cables and isolation transformers through the use of conduits and L-868 light bases. This type of installation will reduce downtime and repair costs when the underground circuits require maintenance. See Appendix 2, Figures 3, and 4.

(2) Pavement overlays. A base and conduit system as described in the preceding paragraph may be used. Two-section bases and spacer rings to reach proper elevation may be required. See Appendix 2, Figure 4.

(3) Existing pavements. Provide recesses or holes for direct-mounted light fixtures or fixtures installed on bases. Isolation transformers are located at the side of the runway. No. 10 AWG wire is run between the transformers and the lights through shallow sawed wireways (saw kerfs) in the pavement surface. See Appendix 2, Figures 5 and 6.

Alternatively, L-868 bases and conduit systems may be retrofitted into existing pavements. Isolation transformers are located within the bases.

b. Electrical System. An L-884 Power and Control Unit (PCU), described in AC 150/5345-54, *Specification for L-884 Power and Control Unit for Land and Hold Short Lighting Systems*, is typically used to power land and hold short lighting systems. The PCU pulses the lights by varying the voltage on the primary side of the series circuit shown in Appendix 2, Figure 7. The light fixtures should be isolated from the series circuit via 6.6/6.6 ampere isolation transformers specified in AC 150/5345-47, *Isolation Transformers for Airport Lighting Systems*.

c. Power and Control Unit (PCU). PCUs may be installed either indoors (Style I) in a vault or outdoors (Style II) near the lighting system, as required. The PCUs may be relatively heavy and, when installed outdoors, must be located as far from the runway as possible to present the minimum possible obstruction to aircraft. They must be mounted at the minimum possible height, and must be located outside the runway safety area, taxiway safety area, and taxiway object free area. If not so located, they must be frangibly mounted with couplings conforming to FAA Dwg C-6046. The safety and object free areas are defined in AC 150/5300-13, *Airport Design*.

d. Control System. The system should have provisions for local and remote control. Local control ("on/off" and intensity control) should be provided at the PCU. Remote control ("on/off" exclusively) should be provided in the Airport Traffic Control Tower (ATCT). If there are two or more land and hold short lighting systems installed on the airport, each system should be installed on dedicated circuits with their own sets of L-884 PCUs. However, two lighting systems installed on the same runway (e.g., installed on opposite sides of an intersecting runway and facing in opposite directions) may be powered from the same set of PCUs through the use of L-847 circuit selector switches specified in AC 150/5345-5, *Circuit Selector Switch*. The L-847 switches should be configured so that only one lighting system at a time may be selected. Appendix 2, Figure 7 shows a typical block diagram of the LAHSO lighting system.

(1) Automatic Intensity Control. When the PCUs are under remote control, intensity selection is automatic and is derived from PCU photoelectric control inputs and sensing of the intensity of the runway edge lights which are installed on the same runway as the land and hold short lighting system. The required intensity levels are described in AC 150/5345-54.

(2) Photocell. A photocell is used to switch the PCU into day or night mode. The photocell is an integral part of a PCU designed for outdoor installation. With the PCU installed, the photocell should be faced north. A PCU installed indoor should have a remotely mounted photocell in a readily accessible outdoor location. The photocell should be installed facing north and be clearly labeled for ease of maintenance. If surrounding airport lights activate a photocell, then it should be turned as necessary to prevent false activation. It is not recommended to gang multiple PCUs on a single photocell, because it would create a single point source of failure.

e. Remote Control. Remote control should be provided in the ATCT through an appropriate L-821 control panel in accordance with AC 150/5345-3, *Specification for L-821 Panels for Remote Control of Airport Lighting*. Where possible, remote control switches should be integrated into existing airfield lighting control panels. Two common methods used to control L-884 PCUs and other equipment are described below.

(1) 120 Volts AC. Where the distance between the remote control panel and the vault is not great enough to cause excessive voltage drop in the control leads, the standard control panel switches to operate the control relays directly should be used. Operating relays supplying power to the L-884 PCUs must have coils rated for 120 volts AC. A #12 AWG control cable should be used to connect the control panel to the power supply equipment in the vault. The curves in Appendix 2, Figure 8, are used to determine the maximum permissible separation between the control panel and the vault for 120-volt AC control. Special pilot low burden auxiliary relays, having proper coil resistance to reduce control

current, may be used to obtain additional separation distance with 120-volt AC control circuits. It may be advantageous to use these relays for expanding existing 120-volt AC control circuits.

(2) 48 Volts DC. Where the distance between the control panel and the vault would cause excessive control voltage drop, a low voltage (48-volt DC) control system should be used. In such a system, remote control panel switches are used to activate sensitive pilot relays, such as those specified in AC 150/5345-13, *Specification for L-841 Auxiliary Relay Cabinet Assembly for Pilot Control of Airport Lighting Circuits*, which, in turn, control the L-884 relays. Appropriately sized cable, of a type which is suitable for direct earth burial, should be used to connect the control panel to the pilot relays. The DC control system has been found to be adequate for up to 7900 feet separation between control point and vault.

(3) Remote Control Using Other Methods. There are many methods of providing for the remote control of L-884 PCUs, L-847 circuit selector switches, etc. Such methods may include ground-to-ground radio control (see AC 150/5345-49, *Specification L-854, Radio Control Equipment*), or copper or fiber optic control lines. Control signals may be digital or analog. Whatever the method used, the airport design engineer is responsible for ensuring that the control system is reliable and that electromagnetic interference does not cause unintended switching of the lighting system.

f. Monitoring. The status of each land and hold short lighting system should be indicated on the L-821 control panel in the ATCT. A monitoring system is a required component of an L-884 PCU and is described in AC 150/5345-54.

7. EQUIPMENT AND MATERIAL.

a. General. Equipment and material covered by FAA advisory circulars are referred to by AC numbers. Equipment not covered by FAA specifications, such as distribution transformers, circuit breakers, cutouts, relays, and other commercial items of electrical equipment, must conform to the applicable rulings and standards of the electrical industry and local code regulations. Electrical equipment should be tested and certified by an OSHA recognized Nationally Recognized Testing Laboratory (NRTL) and should bear that mark. A current list of NRTL's can be obtained by contacting the OSHA NRTL Program Coordinator at 202-219-7193. Table 1 contains a list of equipment and material used for land and hold short lighting systems.

b. Light Base and Transformer Housing. Use a base and transformer housing conforming to AC 150/5345-42, *Specification for Airport Light Bases, Transformer Houses, Junction Boxes and Accessories*. If the secondary wires are fed to the in-pavement lights through a saw kerf, a one-inch hub should be welded to the base at 90 degrees from the two existing two-inch hubs which are 180 degrees apart. A gasket and suitable cover are also required for off-taxiway installation. Local conditions may require other modifications to the bases.

c. Pre-insulated Connectors. When splicing the fixture leads to the #10 AWG THWN wires, pre-insulated connectors, suitable for installation in the wireways, should be used.

d. Auxiliary Relays. Where required, use a hermetically-sealed relay having a single pole double throw (SPDT) contact arrangement rated for 5 amperes at 120 volts AC and a coil resistance of 5000 ohms in a 120-volt AC control circuit. Relay connections may be either solder terminals or plug-in.

e. Optional Sealer Material. Other types of sealer material that provide satisfactory adhesive and waterproofing qualities may be used in lieu of sealer materials P-605 and P-606, upon approval of the engineer in charge. Sealer to be used in asphalt must be compatible with asphalt.

Table 1. Equipment and Material Used for Land and Hold Short Lighting Systems

Item No.	Item Description	Advisory Circulars or Specifications
L-821	Remote Control Panel	AC 150/5345- 3
L-847	Circuit Selector Switch	AC 150/5345- 5
L-824 #8 AWG Cable	Electrical Cable	AC 150/5345- 7
L-824 #10 AWG THWN Cable	Electrical Cable	AC 150/5345- 7
L-824 #12 AWG Cable	Electrical Cable	AC 150/5345- 7
L-841	Auxiliary Relay Cabinet Assy.	AC 150/5345-13
L-823	Cable Connectors	AC 150/5345-26
L-867	Transformer Housing	AC 150/5345-42
L-868	Light Base	AC 150/5345-42
L-850F (unidirectional)	Light Fixture	AC 150/5345-46
or L-850A (unidirectional)	Light Fixture	AC 150/5345-46
L-830	Isolation Transformer	AC 150/5345-47
L-854	Radio Control Equipment	AC 150/5345-49
L-884	Power and Control Unit	AC 150/5345-54
Item L-110	Conduit and Duct	AC 150/5370-10
Item P-605	Joint Sealer, Type III	AC 150/5370-10
Item P-606	Sealer Material (Liquid and Paste)	AC 150/5370-10
Item P-610	Concrete Backfill	AC 150/5370-10

8. INSTALLATION.

a. General. This section recommends installation methods and techniques, however, other methods and techniques, and variations of those outlined here, may be used provided they are approved by the appropriate local FAA Airports Office. The installation should conform to the applicable sections of the National Electrical Code and local codes.

b. Light Fixture Alignment. All unidirectional fixtures should be faced so that they can be seen from the landing direction as shown in Appendix 2, Figure 1. The light beam axis should be aligned parallel to the runway centerline within a tolerance of ±1/2 degree. The light fixture should be level within a tolerance of ±1/2 degree. The top of the fixture edge (highest edge if fixture is not exactly level and/or installed on crowned pavement) should be between +0 inch (0 mm) and -1/16 inch (2mm) from the pavement top. To achieve this result, the light base, whether in one piece or in sections, must be aligned and held in place with jigs until finally secured. This method of installation requires surveying that is precise. The installation must be made with utmost care to avoid very costly remedial action. See Appendix 2, Figure 1 for application of tolerance on crowned pavement sections.

c. Installation of Base-Mounted Fixtures and Conduit System.

(1) New Rigid Pavement. This system is preferred but requires careful attention to detail during installation. One of two conditions will be encountered during installation: the edge of existing pavement will be available as a reference for the new bases, or an existing edge will not be available and the bases must be set "in space." The availability of an existing pavement edge simplifies the task of locating the light base. In both cases, a jig or fixture is required to hold the base in position while the concrete anchor is placed. Azimuth and the elevation of the base with respect to the pavement surface are two parameters that must be met. It is absolutely necessary that the elevation of the flange be at least 3/4 inch (19 mm) below the pavement finished surface. If less than 3/4 inch (19 mm) is left after paving, the light fixture will be unacceptably high. If more than 3/4 inch (19 mm) is left, spacer rings can be used to bring the light fixtures up to the correct elevation. A paving tolerance of 1/2 inch (13 mm) should be allowed when setting the elevation of the fixture. At each light location, an excavation should be made in the pavement base which is large enough to accommodate the L-868 light base, the reinforcing steel cage, and concrete for the anchor. After the excavation is completed, the light base and reinforcing steel cage are installed and held in place with the jig. See Appendix 2, Figure 2. The jig will establish the elevation and azimuth of the base and maintain this position until the concrete

anchor is placed. A recommended practice is to connect each base to the conduit system with a length of liquid-tight flexible conduit as in Appendix 2, Figure 3. Flexible conduit will allow adjustments in light base alignment before the concrete anchor is placed. Care must be taken while placing the concrete anchor that neither the jig nor the light base alignment is disturbed. The jig must remain in place until the concrete has set. During paving operations the light base may be fitted with a steel cover (mudplate). See Appendix 2, Figure 2. After the paving train has cleared the light base, remove excess concrete from the top of the base, and the edge of the opening around the base should be finished to a smooth radius. The surface of the pavement around the light base must be level with the surrounding pavement; dished and mounded areas are not acceptable. After the pavement has hardened, check the elevation of the top flange in relation to the finished surface. It may be necessary to install a flange ring, or flange and spacer ring, to bring the light fixture to correct elevation. Next, install primary cable, transformers, and connectors. Connect light fixture to secondary cable. An "O" ring gasket should be installed and the holddown bolts should be tightened to manufacturer's recommendations. If the paving technique utilizes more than one lift to achieve the required thickness, the above procedure is altered as follows; a sectional light base is required and, after the bottom section has been installed as described above, the first paving lift should be constructed. The flange is then cleaned and the next section is installed with a sealant equal to RTV-118 between flanges, and tightened in place. The paving proceeds, and the fixture is installed as above. Base and conduit systems are subject to water intrusion. Consider base elevations, base heights, conduit slopes, drain holes, and other provisions to facilitate removal of water from the base and conduit system.

(2) New Flexible Pavement. A sectional base is required for flexible pavement. The bottom section of the light base (including concrete anchor) and the conduit system are installed in the pavement base as described in the preceding paragraph.

NOTE: Because of the loads placed on the cover plate during paving, a plywood cover should be a minimum of 5/8-inch (16 mm) thick. If the top section will not be installed right away, a mudplate (1/8 inch (3 mm) galvanized steel cover) should be used.

It is then paved over. The light base, concrete anchor, and conduit backfill must not be higher than the base surface. After the paving is completed, a 2-inch (51 mm) hole is bored to accurately locate the center punch mark of the bottom section cover plate. This hole is used to measure the actual distance from the pavement surface to the top of the cover or mudplate. A top section should be obtained, with a height that will accommodate the fixture and flange ring, and spacer ring if necessary. When the top section is received, a hole 1 inch (25 mm) larger than the diameter of the fixture should be drilled and the top section, flange ring, light fixture, and any spacer rings installed as described above. The space between the walls of the hole up to the top of the top section should be filled with liquid P-606 sealant that is compatible with asphalt. After the P-606 has cured, the remaining space should be filled with P-605, Type III sealant (which is compatible with asphalt) up to the top of the mud dam, if installed, or otherwise up to the top of the flange ring. See Appendix 2, Figure 4.

(3) Flexible Overlay. The installation of a light base and conduit system in a pavement to be overlaid is similar to that of a new flexible pavement installation, except the bottom section of the light base and the conduit are set in openings made in the existing pavement. The required concrete anchor and encasement of the conduit will be similar to that described in the preceding paragraph. The use of a short length of liquid-tight flexible conduit is necessary to allow proper alignment. The remainder of the installation is as described in the preceding paragraph.

(4) Rigid Overlay. The installation of a light base and conduit system requires a combination of the techniques described in paragraphs 8c(1) and 8c(3). The bases and conduit are installed as in paragraph 8c(3); concrete is placed as in paragraph 8c(1).

d. Installation of Direct-Mounted Fixtures. While the installation of direct-mounted fixtures is becoming less common, there are instances where they are still applicable, e.g., overlays. However, they are not recommended for flexible pavement in very cold climates.

(1) Rigid Pavement. Drill holes or recesses in the pavement to accommodate the light fixtures. Saw wireways to accommodate electrical circuits. See Appendix 2, Figure 6, 9, 10, and 11 for typical installation details.

(a) Pavement Drilling and Sawing. Provide approximately 1/4-inch (6 mm) clearance for sealer material between the bottom and sides of the inset base receptacle and the recess. Provide extra depth where sawed wireways cross pavement joints. See Appendix 2, Figure 6 for detail.

1 Prior to placing the inset base receptacle in the drilled hole, clean all external surfaces to assure an adequate bond between fixture, sealer, and pavement. Sand blast if necessary. Avoid handling the fixtures by the leads.

2 Orient the fixture and arrange the leads properly with respect to their splicing position in the wireway. Use temporary dams, if required, for blocking the wireway entrance into the drilled hole. The dams will retain the sealer during the setting of the inset base receptacle. The orientation tolerance for the base is ±1/2 degree. Rugged, well-designed jigs are required to assure proper azimuth, elevation, and level.

3 Cover the bottom of the inset base receptacle with a paste-type adhesive material. Place a sufficient quantity of paste in the drilled hole. Place the base in the drilled hole to force adhesive up the sides of the base at least 1/8 inch (3 mm). Care must be taken to work out entrapped air. Use a liquid sealer (paragraph 7e) to fill the space between the base and the sides of the hole. Liquid sealer should be applied only between the inset base receptacle and the sides of the hole, and should not be applied between the sides of the hole and the top assembly.

(b) Wireways. Prior to the installation of the wires in the pavement, chamfer or round to 2-inch (50 mm) radius, the vertical edges of the wireways at intersections and corners. See Appendix 2, Figure 6. Sandblast and clean wireways to insure proper bond between pavement material and the sealer. If wireways have been wet-sawed, flush these wireways with a high velocity stream of water immediately after sawing. Prior to installation of the sealer, the wireways must be dry and clean.

(c) Wires. Place the #10 AWG THWN wires in the wireways from the transformers near the runway edge to the light fixture leads. An adequate number of wedges, clips, or similar devices should be used to hold the wires in place at least 1/2 inch (13 m) below the pavement surface. The spacing between wedges, clips, etc., should not exceed 3 feet (900 mm). Wood wedges and plugs are not acceptable. Install the top of the wedges below the pavement surface. Splice the light fixture leads to the #10 AWG wires. Use pre-insulated connectors. Make the crimped splice with a tool that requires a complete crimp before releasing. Stagger the location of the splices. Permit no splices in the single conductor wires except at each fixture or L-869 junction box. If the installation is made in stages, tape or seal the ends of exposed wires to prevent the entrance of moisture. Seal the wires in the wireways with Item P-606 material. Apply in accordance with AC 150/5370-10 and the following steps:

1 Pour sealer in wireway until surface of wire is covered.

2 If recommended by the manufacturer, pour clean sand into the liquid sealer until a slight amount of sand shows on the surface. Use clean sand that can pass through a Number 40 sieve.

3 Fill the remainder of the wireway with liquid sealer to between 1/8 inch (3 mm) and 1/4 inch (6 mm) below the pavement surface.

(2) Flexible Pavement. Install direct-mounted light fixtures and wires in flexible pavement in a manner similar to the installation procedures for rigid pavements (paragraph 8d(1)) with the following precautions:

(a) Clean the holes and wireways immediately before installation so that the clean, dry aggregate of the pavement is exposed.

(b) Use sealant which is compatible with asphalt.

(c) Mix the P-606 sealant (for use on fixtures) so that it sets up within 15 minutes.

(d) Use sealant that conforms to P-606 to seal wires in wireways.

(e) Junction boxes may be installed on runways where overlays are anticipated. See Appendix 2, Figure 11. When additional pavement is required, the inset light is removed and the base is fitted with a cover. Paving is then applied over the light base and junction box. When the paving is completed, expose the junction box and light base by coring. Remove covers. Proceed as described in Paragraph 8c(2).

e. Cable Installation.

(1) General. Although primary cables and control cables may be direct buried, it is preferable to install them in conduit in accordance with Item L-108.

(2) Primary Cable Installation. Install primary cable in a trench from the regulator into a light base and transformer housing in the field. Provide slack cable in each light base and transformer housing to permit connections of the primary cable and the isolation transformer primary leads to be made above ground. Seal the cable entrance of the light base transformer housing with squeeze connectors, where specified. These squeeze connectors are provided with a rubber bushing of the correct size to fit the outside diameter of the cable. Tighten the squeeze connectors to provide a watertight seal without deforming the insulation and jacket of the cable. Tape the ends of cables to prevent the entry of moisture

until connections are made. See Appendix 2, Figure 12, for trench detail and wire placement.

(3) Primary Cable Connections. Make in-line splices on the primary underground cables to conform to Item L-108. Use connectors conforming to AC 150/5345-26, *Specification for L-823 Plug and Receptacle, Cable Connectors*. Splices in ducts, conduits, or in the primary cables between light base and transformer housings are not allowed. When field attached plug-in connectors are employed, use a crimping tool designed for the specific type connector to assure that crimps or indents meet the necessary tensile strength. Wrap the connector joints in the primary circuit with at least one layer of rubber or synthetic rubber tape and one layer of plastic tape, one-half lapped, extended at least 1-1/2 inches (38 mm) on each side of the joint. "Heat shrink" material may be used.

(4) Secondary Lead Connections. Connections between the secondary isolation transformer leads and the #10 AWG wires should be made with a disconnecting plug and receptacle conforming to AC 150/5345-26. Attach the L-823, Class B, Type II, Style 4 plug on the end of the two #10 AWG wires using a crimping tool designed for this connector to assure a crimp or indent meets the necessary tensile strength. Insert this connector into the transformer secondary receptacle. See Appendix 2, Figure 5, 9, and 10, for typical secondary wiring details.

f. Identification Numbers. Identification numbers should be assigned to each station (transformer housing installation) in accordance with the plans. Place the numbers to identify the station by one of the following methods:

(1) Stenciling. Numbers of 2-inch (51 mm) minimum height should be stenciled using black paint on the taxiway side of the transformer housing base plate.

(2) Metal Disc. A non-corrosive disc of 2-inch (51 mm) minimum diameter with numbers permanently stamped or cut out should be attached under the head of a transformer housing base plate bolt.

(3) Paint. Numbers of three-inch (75 mm) minimum height should be impressed on a visible portion of the concrete backfill.

g. Duct and Cable Markers. All locations of the ends of ducts and all direct earth burial cable should be marked with a concrete marker slab in accordance with Items L-108 and L-110. See Appendix 2, Figure 12, for duct and cable marker details.

9. INSPECTION.

a. Each light fixture should be inspected to determine that it is installed correctly, at the proper height, in line with the other fixtures, level and properly oriented.

b. All fixture securing screws or bolts should be checked to ensure that they have been tightened in accordance with the manufacturer's recommendations. An anti-seize compound should be used on bolts made of 410 steel with a black coating. See AC 150/5345-46.

c. Each light fixture should be checked to determine that the lenses are clean and unscratched and the channels in front of the lenses are clean.

d. Lighting fixtures should be inspected concurrently with the installation because of the subsequent inaccessibility of some components. Before filling wireways, circuits should be tested for continuity and insulation resistance to ground. After fixtures and cables are installed, the P-606 compound in the wireways and around the fixtures should be inspected to determine that all voids are filled and that the compound is at the proper level with respect to the runway surface.

e. The input voltage at each L-884 PCU should be checked to determine that the voltage is within the limits required for proper equipment operation. Select the proper voltage tap on equipment where taps are provided.

f. The L-884 PCU output current should be checked to determine that it is within the limits specified in AC 150/5345-54. If the current exceeds rated values the lamp life will be reduced.

g. Fuses and circuit breakers should be checked to determine if they are of the proper rating.

10. TESTS.

a. The installation should be tested by operating the system continuously for at least 1/2 hour. During this period, the runway edge light intensity should be changed to ensure the land and hold short lighting intensity changes in accordance with AC 150/5345-54. Proper operation of the photocell should be tested. In addition, each switch should be operated at least 10 times.

b. The performance of the monitoring system should be tested by sequentially removing light fixtures from the circuit until the monitor indicates an error. **WARNING: POWER SHOULD BE REMOVED FROM THE CIRCUIT BEFORE REMOVING EACH OF THE LIGHT FIXTURES FROM THE CIRCUIT.** The

monitor should not indicate an error with 1 light removed, but should indicate an error if 2 or more lights in a single light bar are removed.

c. The completed circuit should be tested in accordance with the requirements of Item L-108 of AC 150/5370-10, *Standards for Specifying Construction of Airports*.

d. The equipment should be tested for proper grounding. This test includes a check to determine that the resistance to ground on any part of the grounding system will not exceed 10 ohms.

11. MAINTENANCE. Maintenance of the land and hold short lighting system should be performed according to the requirements contained in AC 150/5340-26, *Maintenance of Airport Visual Aid Facilities*.

APPENDIX 1. BIBLIOGRAPHY

1. See Paragraph 5 on the cover of this AC for information on how to order or download copies of the following advisory circulars.

Number	Subject
AC 150/5300-13	Airport Design
AC 150/5340-1	Standards for Airport Markings
AC 150/5340-4	Installation Details for Runway Centerline and Touchdown Zone Lighting Systems
AC 150/5340-26	Maintenance of Airport Visual Aid Facilities
AC 150/5345-3	Specification for L-821 Panels for Remote Control of Airport Lighting
AC 150/5345-5	Circuit Selector Switch
AC 150/5345-7	Specification for L-824 Underground Electrical Cable for Airport Lighting Circuits
AC 150/5345-13	Specification for L-841 Auxiliary Relay Cabinet Assembly for Pilot Control of Airport Lighting Circuits
AC 150/5345-26	Specification for L-823 Plug and Receptacle, Cable Connectors
AC 150/5345-42	Specification for Airport Light Bases, Transformer Housings, Junction Boxes, and Accessories
AC 150/5345-46	Specification for Runway and Taxiway Light Fixtures
AC 150/5345-47	Isolation Transformers for Airport Lighting Systems
AC 150/5345-49	Specification L-854, Radio Control Equipment
AC 150/5345-53	Airport Lighting Equipment Certification Program
AC 150/5345-54	Specification for L-884 Power and Control Unit for Land and Hold Short Lighting Systems
AC 150/5370-10	Standards for Specifying Construction of Airports
FAA Dwg C-6046	Frangible Coupling Type I and Type IA, Details
Notice 7110.199	Land and Hold Short Operations (LAHSO)

2. To obtain copies of AC 150/5370-10, mail your request to: New Orders, Superintendent of Documents, P.O. Box 371954, Pittsburgh, PA 15250-7954. Refer to the document being requested as: SN 050-007-00821-0. Send check or money order with your request made payable to the Superintendent of Documents in the amount of $23.00 for each copy. No c.o.d. orders accepted. This AC may also be downloaded from the Airports Internet site at no cost.

3. FAA Notice 7110.199 may be downloaded from the Internet at: www.faa.gov/ats/ato/12014.htm.